

# **VIRTUAL GLOBES MUSEUM A TOOL FOR SAFEGUARDING, COMMUNICATING AND TEACHING CULTURAL HERITAGE**

Mátyás Márton

Department of Cartography and Geoinformatics  
Eötvös Loránd University  
Pázmány Péter sétány 1/A, 1117 Budapest, Hungary  
[matyi@map.elte.hu](mailto:matyi@map.elte.hu)

Gábor Gercsák

Department of Cartography and Geoinformatics  
Eötvös Loránd University  
Pázmány Péter sétány 1/A, 1117 Budapest, Hungary  
[gerscak@ludens.elte.hu](mailto:gerscak@ludens.elte.hu)

## **Abstract**

The Department of Cartography and Geoinformatics at Eötvös Loránd University has recently started a project to save the cartographic heritage of globe making first of all for the interest of professionals, students of cartography and geography in Hungary and abroad. In the first stage, those earth and celestial globes are processed digitally by the staff and students of cartography that have some relationship to Hungary. These digital products are continuously placed in the Virtual Globes Museum run by the Department. The collection of this museum is accessible through the Internet. The methods developed for the virtual museum offer new ways of the virtual restoration of damaged globes without any risk, the reconstruction of virtual facsimile globes, and the recreation of virtual contemporary facsimile globes.

This paper discusses some of the technical advantages of three dimensional virtual globes. The 3D products offer great opportunities to examine the map content in detail. They can be easily handled by a mouse and can be used as demonstration aids in the classroom too. These “new” copies may be most useful for the physical restoration of the existing originals, which are often unique and carefully kept globes. For this purpose, it is most convenient if the map prints of the globes are still available, because they preserved the original state of the product (such as geographical names or colours) much better than the globes that may have been put to damage and light for centuries.

An intermediate stage of the digital processing of an outstanding large globe made in Hungary in 1862 is described to show the challenges that cartographers may meet when working with old globes to prepare their virtual copies. The paper introduces the reader to some of the interesting globes that have already been placed in the Virtual Globes Museum (for instance, the detachable earth globe, the globes of Bleau, Kogutowicz). A

passage tells the reader method the globes are described along with the images of the globes. The description of globes is given in three languages in the virtual museum. The processing of globes by digital methods requires the introduction and discussion of new terms such as digital virtual facsimile, contemporary facsimile and digital virtual reconstruction.

Working out the methods for the digital virtual facsimile and the digital virtual reconstruction of old or historical globes is of major importance in the restoration of globes. In many cases, the colours and letters faded on these globes. The method described in the paper will ensure the restoration without the risk of causing further damage on the existing, sometimes only copies.

**Keywords:** *virtual globes museum; 3D models; globe mutations; globe restoration; digital virtual facsimile; contemporary facsimile; globe reconstruction*

## **Introduction**

There are several museums, libraries, research institutes and schools in Hungary that can be proud of their unique collection of the old earth and celestial globes. Although these objects are an important part of the national cultural heritage, most of them are carefully closed from visitors, and only a few of them are displayed in permanent exhibitions. The Virtual Globes Museum developed at the Department of Cartography and Geoinformatics at Eötvös Loránd University will provide wide access to such globes that can only be rarely seen on display (Márton 2008). This museum was “opened” in the first half of 2008 to serve the safeguarding and popularization of this kind of cultural heritage for the public and for the Hungarian and foreign experts (Márton et al. 2008). A large part of the museum collection can also be considered as demonstration aids in education.

The idea of virtual museums is known from literature (Riedl 2000, Hurby et al. 2005, 2006). However, the authors have no information of another virtual globes museum that would be similar to the museum developed and opened at Eötvös Loránd University, and they do not know about the existence of such a collection. The methods developed for the virtual museum offer new ways of the virtual restoration of damaged globes without any risk, the reconstruction of virtual facsimile globes, and the recreation of virtual contemporary facsimile globes. The development procedure demanded the introduction and clarification of some new terms too, which will be discussed in the paper.

## **3D representation of globes**

Albums and catalogues include colour pictures and descriptions of globes from famous collections. These are mostly accompanied by detailed analyses of the content and the historical background to the time of making of the globe written by experts. What is the

additional value that the Virtual Globes Museum can offer compared to the traditional publications?

The published photographs taken of the globe only show individual pictures of the globe from various aspects and positions. These publications usually present one or sometimes two or three photos of a detail. However, if you enter the Virtual Globes Museum, you can almost hold by your hands the original globes as if they were floating in the air, you can turn them in the space and you can study these virtual bodies from all aspects. If the resolution of the image is large enough, every cartographic element of the map content, including the geographical names, can be examined in detail. The globes are not affected by the damage caused by manual mounting such as the loss of content due to the blocking out in overlapping stripes, or the duplication of the content due to the stretching and improper fitting of the globe segments. Naturally, avoiding these shortcomings may often require restoration and sometimes digital restoration of the damaged parts.

In addition to the images of the globe, descriptive texts can be added that give information on the making, editions etc. The list of references dealing with the object and their availability on the Internet can complete the image of the rotating globe particularly in the case of antique or historically valuable globes. The virtual museum allows us to present the map prints of the globes as well as photos that bring the globes on their stand almost in front of the viewer.

### **Sources for the model of 3D globes**

There are two sources for building up the model of the 3D globes. We are lucky if the map prints of the globe are still available. They are normally composed of a set of twelve segments (if the globe is very big, there may be a series of 18 or even 24 segments). In most cases, these segments are completed by two separate polar caps, which represent the region of the Arctic and Antarctic areas. These caps are also useful to cover the increasing matching errors of the map segments near the polar areas, which evolves when mounting the segments on the base globe. In this case, the scanned segments and polar caps have to be carefully fitted on the surface of the virtual globe by georeferencing their content.

However, if only the earth or celestial globes (that is prints mounted on globes) are available, we may need several good quality copies of the globe to overcome the errors due to the improper mounting or the damage caused by time. In this case, series of photographs of the globes have to be taken. After selecting the best parts of the images, the bits can be fitted on the globe by georeferencing them using the geographical grid. This is in fact the same way as the digital restoration works: the damaged parts of the globes are completed by the help of photographs taken of other available copies of the same edition.

## Terminology

The virtual globes are the facsimile copies of the original. The reproduction is virtual, because the image on the computer display is compiled by the further processing of digital photographs or scanned maps. The product is a *virtual facsimile*. Defining the meaning of *facsimile* is a crucial point. The Explanatory Dictionary of Cartography says the following on page 141: "817.7 facsimile map: The reproduction of an old map true to its original." However, what does "true to its original" mean? May it mean the reproduction of the present state of the map? Generally, this approach is accepted. The colour separation of high-resolution colour photographs of the old maps is used to make the printing originals or plates. The printed *facsimile* shows the present state of the map. The accidental damage and faded colours are reproduced, which means there may be great differences between the present and the original states.

In many cases, the present state of the map is not the same as that of the original. If they are identical, then the product is a *contemporary facsimile*. The original map prints of the globes are normally kept in files and protected from illumination unlike the globes, which faded in time even if they were carefully handled. Those virtual globes that are made by processing the prints will show the contemporary, original map content of the globe.

The damaged parts of a map are usually restored by restorers after studying the undamaged parts of identical or similar publications. If this restoration is carried out on the screen and not on the physical reality of the map, then we arrive at the *virtual restoration*. Today, it seems practical if all kinds of restoration are preceded by a virtual restoration. This procedure cannot damage – often the only – original. In those cases when the virtual restoration results in a product that is illegible on large areas and cannot be interpreted, it may be necessary to re-create the total map. This process will be a *reconstruction* instead of restoration, and if the procedure is carried out on the screen of the computer, then it is called *digital virtual reconstruction*.

## An example of digital virtual restoration and globe reconstruction

A 132 diameter manuscript earth globe made by László Perczel is an important heritage of the Hungarian culture (Figure 1). This globe, which is unique even at international standards, will celebrate the 150th anniversary of its preparation in 2012. The only copy is displayed in the Maproom of the National Széchényi Library in Budapest. Unfortunately, the globe is badly damaged at several places. This means that a careful restoration is needed. The covering lacquer layer has been darkening and turning to yellow. As this process cannot be stopped, the letters and drawings on the globe will become illegible in time. Today, the present state of the globe still allows us to register its content and to, after studying its contemporary sources, it will also be possible to re-create the globe. The objective is the digital virtual reconstruction of this internationally unique, but damaged manuscript globe in two different ways:

- Registration of the present state of the globe in the form of a digital virtual globe, that is the creation of a virtual facsimile (Figure 2).
- Re-creation of the globe (original or contemporary facsimile) by digital reconstruction and digital restoration according to the state when it was made (Figure 3).

Both versions will be placed in the Virtual Globes Museum and will serve the safeguarding and popularisation of the Hungarian cultural heritage both for the Hungarian and international professionals and public.



Figure 1. A unique Hungarian manuscript globe of László Perczel



Figure 2. A part of Perczel's globe as it is today

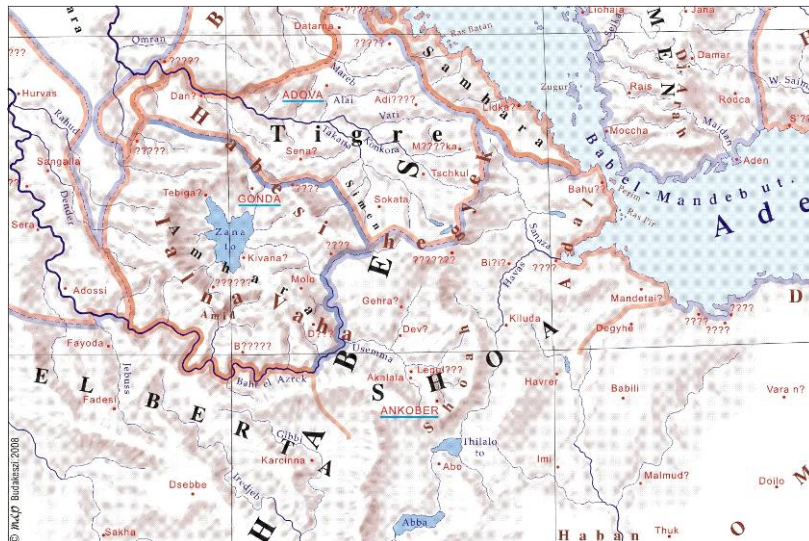


Figure 3. A part of Perczel's globe after digital processing

## Globes in the Virtual Globes Museum

Currently, the museum displays two types of globes: the well-known earth globes and the less frequent celestial globes. The images of the first two types of globes can be viewed in any position and rotated in any direction without limitation. Zooming in and out of the 3D globe by a mouse is simultaneously possible on the screen of the computer.

It is a major objective of the museum to develop its collection of globes related to Hungary in some way. The museum identifies and collects those globes that were made by Hungarians at home or abroad either in Hungarian or in another language. For instance, the German language globe made by the first “modern” Hungarian author, Ferenc Elekes in Vienna in 1831 is already placed in the museum. Naturally, those globes are also of interest for the museum which were made in Hungarian in other countries. Such globes were produced among others in East Germany by VEB R  thgloben-Verlag in Leipzig.

The museum collects “new” globes too. The representation of historical maps on virtual globes is not a new idea, though not old either. Among the pioneers of this method is the Hungarian Gyula P  pay, professor of the Department of History at the University of Rostock in Germany (P  pay 2006). He donated the world maps of Strabon (1st c. BC) and Ptolemy (2nd c. AD) fitted on globes to the Virtual Globes Museum.

There are several globes kept in various Hungarian collections, and many of these copies represent great cultural value. They are often important relics of the cartographic history. For instance, the digital versions of Bleau’s earth globe and celestial globe from the first half of the 1600s (the originals are exhibited in the small town of Zirc) or Perczel’s globe from 1862 can be representative items in the Virtual Globes Museum. Naturally, famous globes that are not related to Hungary in any ways, such as the Coronelli globes (17th c.) may also find their place in the museum.

The collection includes two pieces of special interest: a detachable earth globe (Figure 4), which demonstrates the inner structure of the Earth (Hajdu and M  rton 1986), and a “truncated” celestial globe, which shows those stars only that are visible from Germany and leaves the others out. The third type of globes, the least known armillary spheres are not yet entered into the virtual museum. They are ringed globes or astronomical globes that modelled the celestial spheres in the Roman times or middle ages by the rings of the equator, ecliptic, horizon, meridian, tropics, polar circles etc. The scaled rings were also used to measure angles. In the near future, armillary spheres will also be visible in the museum.



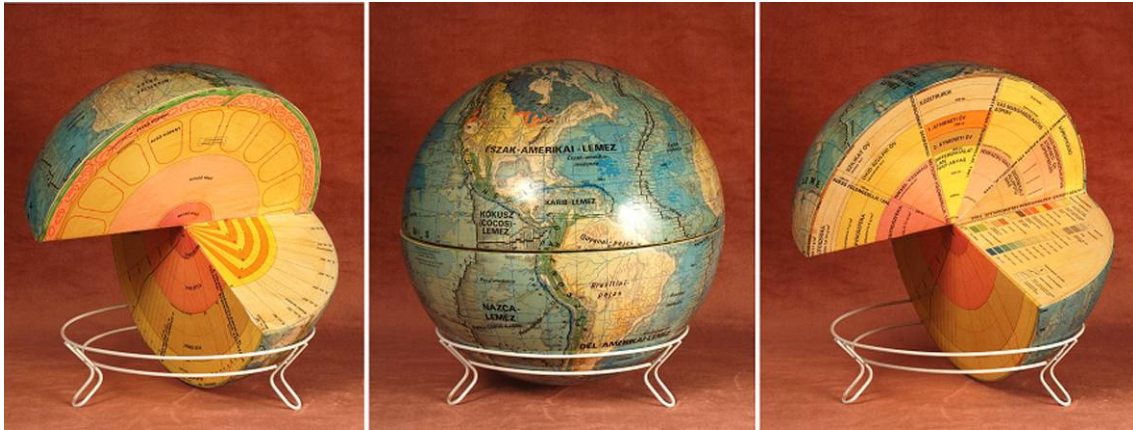


Figure 4. The Hungarian version of the 40 cm diameter detachable structural morphological Earth model

The collection in the Virtual Museum of Globes is continuously expanding and is accessible at <http://vgm.elte.hu> in English, German and Hungarian. Naturally, the languages refer to the descriptions only. Therefore, several “language mutations” of the same globe may be seen in the collection. Cartographia Enterprise, a former map publishing company in Hungary often published such globes between 1966 and 1990 (Márton 1988).

The globes made by Manó Kogutowicz (1851–1908) were recently digitally processed on the occasion of the 100th anniversary of his death. They represent another type of mutations of the same globe by presenting them in different colours. Today, preparing such globes by computer is easy. However, their production required a new lithographic technology at the turn of the 19th and 20th century. This explains why there are only few examples of such globes in the world.

### Services provided by the Virtual Globes Museum

The elements of the services offered by the museum can be described as dynamic and static. The *dynamic elements* are the globes that can be turned, expanded or reduced in size on the screen.

The *static elements* include descriptive texts of the globes and the pictures of globes, map prints etc. The description and explanation of the globe is a most important part of these elements. They contain the following items (if known): title; author(s): editor, designer, graphic artist (relief shading), draughtsman, lithographer, copperplate engraver etc.; publisher; place of publishing; year and number of publishing (year of the first edition and the number of total editions); conditions of edition(s); production technology (of the original and of the virtual globe); support; language; title field; general description; diameter of the globe, scale; the content elements of the globe map;



the processed copy and its origin; other available copies in Hungary; names who processed the source map; name who wrote the text; name who took the photographs; references to literature.

## Conclusions

Working out the methods for the digital virtual facsimile and the digital virtual reconstruction of old or historical globes is of major importance in the restoration of globes. This will ensure the restoration without the risk of causing further damage on the existing copies. All physical restorations of earth or celestial globes should be preceded by the digital processing of their content.

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